Earth & Environmental Sciences Division

# News, Views & EEScience



## Safety

### A Message from Jeff

Jeff Hansen, Division ES&H Officer,
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## Field Work Plans, Buddy System, and Satellite Telephones

Working alone in an office is a common and accepted practice. This is based on the assumption, if you have a problem that could incapacitate you, will be able to get help from someone nearby? In fieldwork this is not generally something you can count on. The "Buddy System" is an old but useful process that is something we rely on in nearly all of our fieldwork or experimental activities. With a second person to go for help or render aid, small injuries stay small, while major injuries or problems can usually be dealt with quickly if there is a second person. Having a plan to deal with injuries and other problems is the main reason we have fieldwork plans. The ability to declare an emergency at some level and to communicate with assistance is essential and entirely in the hands of the field team. For the last year, we have provided satellite telephones (four) to field teams. Typically, these teams also have Global Positioning System capabilities to determine a team's location and this probably isn't an issue if we can communicate this information to rescuers. We need to make these items part of our fieldwork culture. We expect to get more satellite phones. The Reliability of the phones has been excellent and the cost is acceptable. Note: These devices do not replace a "buddy". Up front planning for a second person is essential when we are working in the field.

## Security

### An Ear on the LIR from Tony

Tony Montoya, Acting Division Security Officer (DSO), 7-8065, antonio@lanl.gov

## Classified Holdings

S-5 conducted a Classified Matter Protection and Control (CMPC) annual self-assessment of classified holdings in EES-DO last week, as mandated by the Safeguards and Security Program, DOE Order 0 470.1. Our Division did well, that is to say, that we had no findings; however, I would like to encourage each member of our division who handles classified matter to take a CMPC class annually.

## Student & Mentor News

Alexis Lavine, EES Student Liaison
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### Manvendra Dubey wins Mentor Award

"An example of a mentor who has gone above and beyond the call of duty is Dr. Manvendra Dubey from EES-6." Jacob Hedden wrote these words describing his mentor, "Dubey." He also states, "Much like most other mentors and researchers at the lab, he is an extremely busy person and rarely has free time, yet he still finds time to check up on me and make sure my summer progressing

smoothly. He is concerned with my well-being and that my experience at the lab is a positive one." Congratulations, Dubey!

## Transitions - A Rock Solid Message from Terry Wallace

### EES Search Committees

Division Leader: The search is under way, and has been advertised internally and externally in national professional organization journals. The committee is chaired by Dr. Al Sattelberger, the Division Leader of Chemistry.

EES-2 Group Leader: The search is under way and was advertised nationally. The committee is chaired by Dr. George Guthrie (EES-6).

EES-7 Group Leader: The search is near completion.

### Dollar$ and $ense New$

The Earth and Environmental Sciences Division has a very broad research portfolio. In FY 2003, the division's budget was approximately $65 million dollars. This funding is the composite of 12 major projects, the largest of which is the Yucca Mountain Project (YMP); this project accounts for 18 percent of our portfolio. The fact that the Division has a diverse funding base has many advantages, including natural balances between the waxing and waning interests of sponsors. However, the reliance on numerous moderate-to small-sized projects also poses some serious challenges. Among the challenges are the nearly constant scrambling for funding that is usually done in a reactionary mode; decisions are made at the national or Laboratory level about priorities without EES's input; this then drives our staff to propose research with short-term goals. This reactionary mode often results in low morale and eroding capabilities. Strategic planning is an attempt to ameliorate this "reactionary mode". Strategic planning clearly defines objectives and assesses both internal and external challenges to identify problems that effect national security (broadly defined). Once these problems are identified and prioritized, a strategy is formulated and implemented.

### Strategic Planning Retreat

EES will be having a strategic planning retreat on August 20. We have designed a retreat to explore both the process of planning and begin to identify future thrust areas. The retreat will include the group and deputy group leaders, representation from among the present project portfolios, the SELT, and the division office. Although the size of the retreat is limited, it is my hope that all division personnel can and will contribute to strategic planning. The intellectual capital of EES resides in our members and your ideas will help shape our future. What are the impending problems in the next decade that will affect national security? For example, how will the quality and quantity of water affect the economies of North America, and what is earth sciences contribution to a solution? I am asking you to think about the future on the time scale of decades. The August 20 retreat is just a first step and the planning for the future must be a long-term process. **I urge you to pass your ideas on to your Group Leaders, Deputies, or the SELT.**

### Service Anniversaries & Congratulations to the Following:

Paul Johnson, EES-11, 25 years
Mike Fehler, EES-11, 20 years
Paula Geisik, EES-6, 15 years
Scott Elliott, EES-2, 10 years
Maureen McGraw, EES-6, 10 years
Phil Stauffer, EES-6, 10 years

# News from the Science and Engineering Leadership Team

Manvendra Dubey, Chair,
5-3128, dubey@lanl.gov

The SELT has been engaged in learning from and helping integrate the program development activities within EES. Over the last month we were briefed by and had meaningful discussions with individual program/thrust leaders in the areas of Yucca Mountain science, carbon management, weapons effects, hard and deeply buried targets, test readiness, and predictive science. We responded by initiating some specific ideas and proposals and are integrating and consolidating input from program managers to effectively leverage emerging opportunities in these areas at the Division level. Our efforts are a follow up to our role and position in helping with integration of program development and with the strategic thrusts in EES that were articulated and delivered to the Acting Division Leader (DL) recently, and is excerpted below.

"EES program development, both internal and external, is an integral role of the SELT. The SELT recognizes the value of the recent alignment of program managers with EES. For this to be effective, we need to develop and implement a mechanism for program/thrust leaders, to communicate with and inform the EES leadership (Division Leadership Team (DLT) and SELT) and the staff on a regular basis. The SELT recently helped effectively communicate Center of Homeland Defense Program activities to the staff in partnership with our homeland security thrust contacts. We are planning to help integrate with the internal EES program/thrust leaders. Furthermore, the SELT's experience in the LDRD process, where many of the exiting new scientific ideas are developed, will be shared with program managers to market these innovative technical ideas to other programs and agencies. The SELT, at the request of the DL, will work with the DLT, program managers, and thrust leaders to better define and strengthen the technical plans of our strategic initiatives. The SELT has begun meeting with EES-leads in water, carbon, weapons effects, and repository and predictive science to facilitate this integration. SELT representatives will participate in the day long EES retreat in August to help assess and update our thrusts, programs, and capabilities. Our efforts link naturally to our formal role, together with the DLT, in helping coordinate EES input on both ongoing and future initiatives within our Directorate (SR). SELT will actively solicit such input at group meetings and other appropriate forums. By providing the TSM perspective, the SELT complements and enables the efforts of the DLT and thrust leaders."

We will be hosting an open EES meeting to gather unfiltered input from staff on EES thrusts, capabilities, and vision statement that we will be bring to the table at the EES retreat next month.

The SELT employee survey and study on the UC-LANL management issue has been delivered to Pete Nanos and the Senior Executive Team and was recognized as very thoughtful and valuable by Tom Meyer and some other ADs. This study was also valued by our Division Review Committee and has been forwarded both to the UC Science and Technology Panel and is likely to be forwarded to the UC Council. Again, SELT sincerely thanks all the EES staff for the strong, candid, and thoughtful input that enabled us to

analyze these concerns effectively. We all have served LANL well by being proactive in responding to our DRC's request in a timely manner and have succeeded in creating informed awareness on this important issue at a very high level.

Finally, I will be passing the baton to Chris Bradley, EES-11, who was selected as SELT chair and will begin his term on August 11. It has been my pleasure and privilege to serve you all as SELT chair over the past three months, and we all are looking forward to working with Chris to continue to serve you all.

## NEW from the Research Library:

## SciSearch Plus,
**Science Citation index**
**@http://search.lanl.gov**

## Weekly Highlights / Accomplishments sent to ADSR

### National Energy Technology Laboratory Reviews Los Alamos' Carbon Projects

Scientists Bill Carey and Mike Ebinger from the Earth and Environmental Sciences Division (EES) presented two projects relating to Los Alamos' work on carbon dioxide mineralization and terrestrial sequestration to the National Energy Technology Laboratory (NETL) on June 4, 2003. The reviews were presented to the NETL International Engineering Board. Carey's presentation included EES's experimental and theoretical work on carbon dioxide mineralization. The board was encouraged by this approach and the progress, which was surprising given the board's initial skepticism on this concept for carbon sequestration. Ebinger presented Los Alamos' program in terrestrial sequestration that focuses on novel monitoring methods (lasers and microbes) for carbon fluxes in ecosystems. This presentation stimulated a number of enthusiastic questions from the board both during the review and during the break. **Los Alamos' efforts in carbon are focused on understanding anthropogenic and natural carbon cycles as well as their coupling.**

### DOE and Nuclear Energy Institute Tour Yucca Mountain

Tours were conducted by Bruce Reinert of the Earth and Environmental Sciences Division's Yucca Mountain Project, on June 24 for DOE Consultants, Michael Kilpatrick, Deputy Director, Office of Independent Oversight and Performance Assurance, and Robert Nelson, Consultant. On June 25, Reinert toured managers from the Nuclear Energy Institute that included Steve Kraft, Director, of Spent Fuel and Chuck Dugger, Vice President of Operations.

### Los Alamos and Livermore Collaborate on Test Readiness

Earth and Environmental Sciences Division scientists, Christopher Bradley and Wendee Brunish, met with their colleague, Dave McCallen, Laser Science Division, at Lawrence Livermore National Laboratory on June 25 to discuss the coordination plans for the containment aspects of the Enhanced Test Readiness program. Los Alamos and Livermore are collaborating on a number of topics, including stemming design, gas flow modeling, and containment diagnostics development. **The goal of the program is to achieve an 18-month readiness posture for underground nuclear testing by September 30, 2005.**

## FIRETEC Code Wins R & D 100 Award

FIRETEC, represented by researchers, in the **Earth and Environmental Sciences Division**, Theoretical Division, and the United States Forest Service was awarded one of the eight Los Alamos R&D 100 Magazine 2003 awards. FIRETEC is a Physics-Based Wildfire Model and is a three-dimensional (3-D) computer code designed to simulate the constantly changing, interactive relationship between wildfire and the environment. It simulates the dynamic processes that occur within a fire and the way those processes feed off and alter each other. Los Alamos received more awards than any other Department of Energy laboratory. In recognizing the achievement, Interim Laboratory Director G. Peter Nanos noted that "many of these award-winning technical innovations were born out of Los Alamos' mission to create science that serves society. This is evidence to the fact that Los Alamos remains home to some of the best science and brightest scientific minds in the world. These innovations are the result of our pursuit of ideas that change the world."

## Earth and Environmental Sciences Workshops

The 2nd **North American Luminescence Dating Workshop** will be held in Albuquerque New Mexico, USA, August 14-16, 2003. **Kenneth Lepper**, the technical organizer from the Earth and Environmental Sciences Division notes that the workshop is of particular interest to researchers who have activities or interest in luminescence dating. The general technical sessions will highlight current research in optical stimulation luminescence dating and a special session will be offered on "Retrospective Accident Dosimetry / Personal Dosimetry".
http://www.ees10.lanl.gov/osl/NALDW2.htm

The 2nd annual "**Workshop on Community Finite Element Models for Fault Systems and Tectonic Studies**" will take place on August 25-29, 2003, at Los Alamos National Laboratory. The progress of numerical modeling of lithospheric deformation, benchmarking existing codes, and defining challenges that need to be met for future software development will be discussed. Particular attention will be placed on issues associated with meshing of complex domains, computational frameworks, solution methods well adapted to MPI environments, and to the definition of rigorous benchmarks. SCEC, Los Alamos, and NASA are providing partial support for the workshop.
(http://www.scec.org/workshops/cfem)

The Institute for Geophysics and Planetary Physics is sponsoring a workshop on **Fluid Flow and Transport through Faulted Ignimbrites and other Porous Media** at Ghost Ranch in Santa Fe, New Mexico, USA on September 8-10, 2003. The Los Alamos contact is **Claudia Lewis** in the Earth and Environmental Sciences Division. The workshop will explore porous media, including volcanic and clastic sedimentary materials that exhibit a wide range in mechanical and hydrologic properties. The purpose of this workshop is to explore this range, with the goals of: 1) investigating physical controls on fault-zone deformation; 2) quantifying the hydrologic properties of structures produced by different deformation mechanisms; 3) utilizing fault-zone diagenesis as a record of fluid-rock interactions; and 4) developing methods to effectively model flow and transport through faulted porous media. The workshop includes a field trip to examine faults in the Bandelier Tuff, exposed in Bandelier and Tent Rocks National Monuments near Los Alamos. In addition, the trip will explore a range in fault-zone structures from fractures to deformation bands and will set the stage for discussing the hydrologic implications of the petrophysical and structural heterogeneity of faulted tuffs.
http://www.ees.nmt.edu/Geol/Faults/Faults-flow

# Earth & Environmental Sciences Division

## Historically Black Colleges and Universities Tour Yucca Mountain

Alan Mitchell of the Earth and Environmental Sciences Division's Yucca Mountain Project, Nevada (YMP) led a group of ten individuals from the Historically Black Colleges and Universities Scholarship Program at YMP on July 15. In addition, 42 members of the Repository Design Group for the Project attended the tour. The project is scheduled to submit a license application to the Nuclear Regulatory Commission for approval to become a high-level nuclear repository. The application will include a design for the repository, including canister, surface, and subsurface facilities. **The Repository Design Group's engineers are preparing this design**.

## Los Alamos Scientists Present at International Union of Geodesy and Geophysics

Dr. Michael Fehler of the Earth and Environmental Sciences Division's (EES) Geophysics Group presented the talk, "Influence of Random Media structure on Periodic Ripples of Coda Envelopes," at the International Union of Geodesy and Geophysics that was held in Sapporo, Japan from June 20 - July 11. The paper was coauthored with Professor Haruo Sato of Tohoku University in Sendai, Japan.

Dr. Fehler was also coauthor on a talk titled, "Synthesis of wave envelopes in random media using the Markov envelope as a propagator in the Radiative transfer theory." The lead author on this presentation was Professor Haruo Sato. An additional author was Dr. Tatsuhkio Saito of Tohoku University.

Dr. Fehler co-chaired the session on "Seismological Observation and Interpretation," and participated in a working group meeting as a **member of the Task Group on Scattering and Heterogeneity**.

A special workshop on July 10 was presented by Fehler at Tohoku University in Sendai, Japan on "Seismic waves in the heterogeneous earth: more applications to seismology and exploration geophysics." A paper presented by Fehler and authored by Fehler, Haruo Sato (Tohoku University), and Fred Pearce (Earth Resources Laboratory of Massachusetts Institute of Technology) was titled, "Characterization of Spectrum of Random Medium from Trace Measurements." Fehler also chaired one of the two afternoon sessions at this workshop.

The full day session on "Coastal Zone Sciences," chaired by Dr. Gary Geernaert of EES's Institute for Geophysics and Planetary Physics, was presented during this session titled, "The Coastal Drag Coefficient - Theoretical Developments and Implications for Air/Ocean Sciences."

Dr. Greg Valentine and Dr. Grant Heiken, of EES's Hydrology, Geochemistry, and Geology Group, chaired a session titled, "Assessing Volcanic Risk." The session featured numerous talks and posters, including two presentations on EES's work on **volcanic risk for the Yucca Mountain Project**.

## Los Alamos Presents Nonlinear Acoustics at the Ultrasonics International Conference

Researchers from the Earth and Environmental Sciences Division (EES) presented three invited talks at the Ultrasonics International 2003 Conference held in Granada, Spain, June 30 through July 3. The talks presented are the results of work in the Nonlinear Acoustics Laboratory in EES's Geophysics Group. Jim TenCate presented an invited talk to kick off a special session on "Nonlinearity for Materials Characterization." His presentation, "Dynamic nonlinear ultrasonics at small strains" was co-authored by Paul Johnson also in EES's Geophysics Group. Alexander Sutin, Stevens Institute of Technology and Paul Johnson were authors of a talk titled,

"Slow dynamics and its application in NDE." Sutin, TenCate, and Johnson were also authors of a talk titled, "Application of nonlinear time reverse acoustics to isolate cracks in solids." **The research into nonlinear material behavior conducted in EES's Non Linear Acoustics Laboratory is performed on earth materials because they exhibit peculiar nonlinear behavior and the more we understand this behavior the better we will understand mechanisms at play in fatigue cracking, seismology, non-destructive testing and imaging, nonlinear acoustic microscopy, and even imaging the human body.**

## Yucca Mountain Tours National Academies Committee and Academia

Richard G. Kovach of the Earth and Environmental Sciences Division's Yucca Mountain Project conducted a tour for the National Academies Committee on Transportation of Radiological Waste on July 23. Included in the tour from the National Academies was Dr. Kevin Crowley, Director, Board of Radioactive Waste; Joseph Morris, Senior Program Officer; Steve Mautner, Executive Editor; Darla Thompson, Research Assistant; and Lee Finewood, Intern. Also included in the tour were Clive Young, Director, Radioactive Materials Transport Division, Department for Transport, United Kingdom; Thomas Deen, Consultant, Transportation Research Board; Dennis Bley, President, Buttonwood Consulting, Inc.; Joseph Sussman, Professor, Massachusetts Institute of Technology; Thomas Warne, President, Tom Warne and Associates, LLC; Neal Lane, Professor, Rice University; and Julian Agyeman, Assistant Professor, Tufts University.

## Los Alamos Hosts 8th Nonlinear Elasticity in Materials Workshop

The 8th International Workshop on Nonlinear Elasticity in Materials was held at the La Fonda Hotel in Santa Fe, NM July 28 - August 1, 2003. Additional details @ http://internet.cybermesa.com/~paulj/iwnem/

## Los Alamos' Hawkins Trains the Next Generation of Nuclear Weapons Policy Grads

Ward Hawkins of the Earth and Environmental Sciences Division presented an invited lecture on "Verification Technologies: Nuclear Test Monitoring-International Monitoring System" as part of an National Science Foundation (NSF)-sponsored Ph.D. training program held at the Institute on Global Conflict and Cooperation, a multi-campus research unit headquartered at University of California, San Diego. The course entitled, "Public Policy and Nuclear Threats: Training the Next Generation" is for students throughout the University of California system and is funded through NSF's competitive Integrative Graduate Education and Research Training program. This program is a response to the problem that the **cohort of experts on nuclear weapons policy in all disciplines is heading toward retirement and not being replaced adequately with new Ph.D.'s.**

## Los Alamos Leads the Way in Event Classification

Drs. Terry C. Wallace, Jr., CL Edwards, Steve Taylor, and Lee Steck of Los Alamos' Earth and Environmental Sciences Division (EES) attended the Air Force Technical Applications (AFTAC) Center Seismic Review Panel Meeting on July 22 to July 23 at AFTAC. EES's Wallace, the Acting Division Leader, serves on the Seismic Review Panel, an oversight group for AFTAC. Taylor gave a presentation titled, "Integration of Regional Data into the Event Classification Matrix". AFTAC is charged with monitoring nuclear testing worldwide. Los Alamos scientists play an important role in developing the knowledge and techniques that allows AFTAC to accomplish its mission. One example of Los Alamos' products is a new paradigm for identifying the seismic signatures of

explosions. The Event Classification Matrix (ECM) is a statistically based procedure developed from an extensive training set of explosions and earthquakes. **Characteristics of the explosion seismograms allow a quantifiable procedure for classifying an unknown seismogram. EES has taken the lead in developing this new technique.**

## Los Alamos' Elastic Wave Stimulation of Oil Production Invited to Best of 2003 D&P Forum

Drs. Peter Roberts and James Albright of the Earth and Environmental Sciences Division attended the annual Development & Production (D&P) Forum for the Society of Exploration Geophysicists (SEG) on July 20-23 at Big Sky, Montana. Roberts and Albrights' research was presented to an audience of 31 attendees from the oil and gas industry, National Laboratories, and Universities. Roberts was on the Forum Organizing Committee and chaired a special technical session devoted to current research and application efforts on "Elastic Wave Stimulation of Oil Production". This was the first formal technical session focusing on this topic at any SEG conference. Speakers for six oral and one poster presentation were invited. The keynote speaker, Dr. Igor Beresnev of Iowa State University, delivered a talk that was voted the best of the Forum. Both **Beresnev and Roberts have been invited to give their presentations again at the upcoming Annual SEG Conference** in Dallas, in a special workshop titled, "The Best of the 2003 D&P Forum".

## Los Alamos' Barnes Filming Interviews for New ARM Kiosk

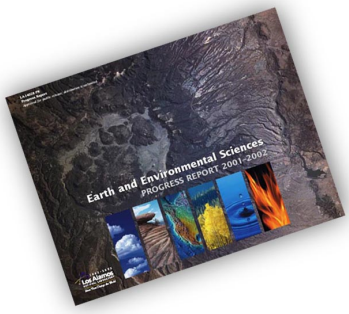
A biologist, Dr. Fairley Barnes, in the Earth and Environmental Sciences Division is currently half way through a five-week trip to the Tropical Western Pacific filming interviews with native educators and officials for the Atmospheric Radiation Measurement (ARM) Education and Outreach project. In the past two weeks, Dr. Barnes and a film crew from Australia and New Zealand have been interviewing residents of the islands of Manus, Nauru, Papua New Guinea, Los Negros, and Samoa. She will be in Samoa at a meeting of the SPREP (Southern Pacific Region Environmental Program) and she will continuing with interviews until her return to Los Alamos in mid-August. The purpose of the interviews is to build an educational kiosk (like what we use at the airport for e-tickets) of native perspectives on climate change in the Pacific. This effort supports previous efforts to include significant educational materials in the regions' K-12 curricula. The kiosks, two of them initially, will be available at educational institutions or local museums and will reflect the ARM program and the local perspectives on how the Earth's climate is changing from a native point of view. **This effort follows a successful kiosk development effort for the North Slope of Alaska ARM site, and the Alaska kiosk will be dedicated in October 2003**.

## *Winner of the June Mystery Image:*

1st Place: Jean-Francois Lucchini, EES-12
2nd Place: Jim Craig, EES-7

### It was the Waste Isolation Pilot Plant (WIPP)!

The Los Alamos Carlsbad Operations (CB), EES-12, was established in April of 2000 and later that year it became the senior technical advisor for transuranic waste (TRU) characterization for WIPP. In April of 2002, CB became EES-12. EES-12 provides core scientific and engineering expertise to DOE's Carlsbad, NM, field office. Read more in the Progress Report 2001-2002, page 23. Also, see the Guest Editorial for a technical report of WIPP's science.



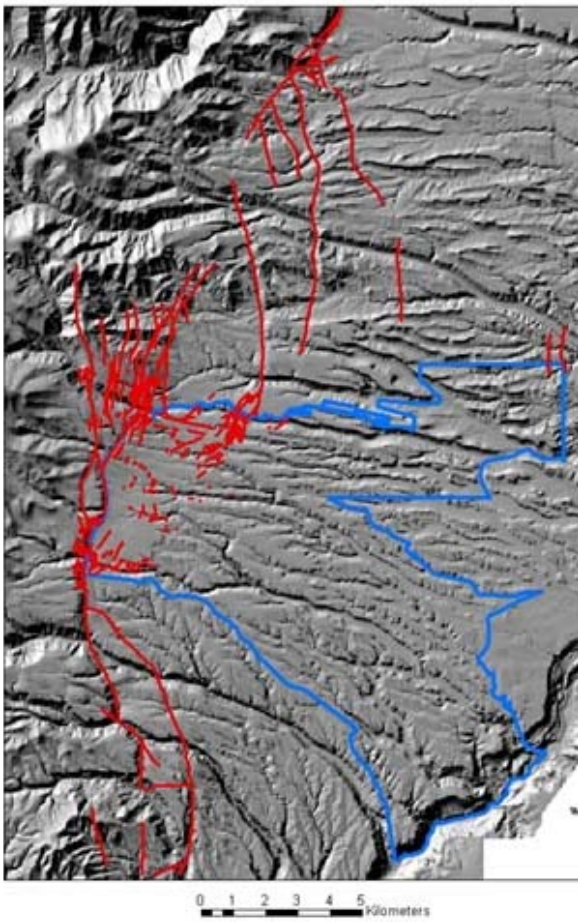

http://www.ees.lanl.gov/pr/index.shtml

### Dottie's Mystery Image for July: what is the location of this image?

Is this an image of

- Danube River and Canals?
- Rio Grande Rift?
- Drainage basins of the Jemez Mountains?

*Respond to: dot@lanl.gov*



EEScience

## Guest Editorial

# Actinide Chemistry in Carlsbad: a new LANL team supports WIPP re-certification activities

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A major goal of EES is to provide key expertise to the Department of Energy (DOE) in nuclear and radioactive waste repository science. The Division's Carlsbad group (EES-12) has key technical advisory roles in the areas of actinide chemistry, waste characterization, waste optimization, and Transuranic Package Transportation II (TRUPACT-II) for the Waste Isolation Pilot Plant (WIPP) activities.

To accomplish this mission, the Actinide Chemistry (AC) team has recently initiated three major improvements:

- *in collaboration with Carlsbad Environmental Monitoring & Research Center (CEMRC) of New Mexico State University (NMSU), facility upgraded to do actinide research was initiated;*
- *two distinguished scientists with extensive background in actinide research were hired; and*
- *a new actinide chemistry research program emerged.*

This paper briefly describes the new directions of the AC team.

## Background

The Department of Energy Carlsbad Field Office (DOE CBFO) currently operates the WIPP (see Figure 1) near Carlsbad, New Mexico, as an underground repository site for transuranic (TRU) waste generated as part of the nuclear defense research and production activities of the federal government. To address near and long-term scientific and technical issues pertaining to the certification and operation of the repository, CBFO created the Actinide Chemistry and Repository Science program with Los Alamos National Laboratory (LANL) as the lead laboratory. LANL has formed a scientific partnership with the Carlsbad Environmental Monitoring and Research Center (CEMRC) that will allow for a collaborative implementation of the actinide chemistry and repository science program, taking advantage of CEMRC's existing resources in staff, facilities and equipment, augmented by LANL equipment and staff.

Figure 1: Overall view of the surface of the Waste Isolation Pilot Plant (WIPP), near Carlsbad, NM.

The Carlsbad Environmental Monitoring & Research Center is a division of the College of Engineering at New Mexico State University (NMSU). CEMRC is currently operating a 26,000 ft2 building with environmental and radiochemistry laboratories, in vivo bioassay facility, mobile bioassay laboratory, computing operations and offices http://www.cemrc.org/. Twenty-two staff members are actually carrying out several research activities, including an integrative WIPP Environmental Monitoring project. In this context, CEMRC is a major scientific research facility in the Carlsbad area.

## The LANL/CEMRC collaboration

The collaborative effort between LANL/Carlsbad Office and CEMRC began in April 2001 and is supported directly by DOE and contractually between LANL and CEMRC.

The extent of this collaboration has been recently increased. Within the last month, CEMRC has accommodated all of the LANL Actinide Chemistry equipment and staff in its facility.

The LANL team brings new, state-of-the-art equipment to add to the already considerable resources at CEMRC (see List 1):

- *a Nd:YAG Master Oscillator Power Oscillator (MOPO) laser system which will provide a tunable source laser for photoacoustic, fluorescence and breakdown spectroscopy applications;*
- *an X–ray diffractometer using Bragg-Brentano or parallel-beam geometry (Göbel mirrors) combined with phase quantification by Rietveld and least-squares-refinements, and with phase constitution analyzed to temperatures/pressures up to 600°C and 1 Mpa;*
- *an Unsaturated/Saturated Flow Apparatus UFA (see Figure 2) that can directly measure all transport properties, saturated or unsaturated in any porous media (rock, cement, ceramic, soil and others); and*
- *a state-of-the-art Cary 500 UV–Vis spectrophotometer with temperature control, multi-sample capabilities and less than 0.1 nm resolution.*

Figure 2: Jim Conca is operating the UFA.

The Unsaturated/saturated Flow Apparatus can decrease significantly the time required to obtain direct measurements of transport parameters. The UFA method can be applied to any porous media.

List 1: Major equipment at CEMRC (in brackets, LANL property)

- *X-ray diffraction apparatus (LANL)*
- *UV-Vis spectrometer CARY 500 (LANL)*
- *Nd:YAG laser coupled with a MOPO (LANL)*
- *Inductively-coupled plasma spectrometer*
- *Atomic absorption spectrometer, with flow injection system and mercury analysis system*
- *Gas chromatograph-mass spectrometer (LANL)*
- *Gas chromatograph (LANL)*
- *Ion chromatograph*

- *High capacity sample concentrator (LANL)*
- *Soxhlet extraction unit (LANL)*
- *Microwave digestion systems (2 units)*
- *Alpha spectrometers (72 units)*
- *Germanium coaxial gamma-ray spectrometers (2 units)*
- *Germanium well gamma-ray spectrometers (2 units)*
- *Liquid scintillation counters*
- *Low background gas proportional counter (4 units)*
- *Automatic sample changing gas proportional counter*
- *Air sampling equipment (high and low volume, dichotomous, multi-orifice impactor)*
- *Microbalances (2 units)*
- *Meteorological instrumentation (2 stations)*
- *UVB-1 Pyranometer*
- *Unsaturated flow apparatus UFA'(LANL)*

Another result of the LANL/CEMRC partnership is the relocation of the LANL Actinide Chemistry staff to the CEMRC facility. Offices were provided to the LANL staff, and three laboratories are now dedicated to the LANL actinide chemistry project that supports the WIPP.

## A new Actinide Chemistry staff

Two distinguished scientists have recently joined the Actinide Chemistry team (see Figure 3) in Carlsbad:
Dr. Marian Borkowski and
Dr. Donald T. Reed.

Figure 3: The AC team at the CEMRC facility.

From the left to the right: Marian Borkowski, Donald Reed, Jean-Francois Lucchini, Jim Conca, Andrzej Rafalski.

Marian Borkowski is an expert in chemistry of actinides and separation methods as chromatography, ion exchange, and extraction. He came to the US from Poland, working there as deputy head of Radiochemistry Department at the Institute of Nuclear Chemistry and Technology. He worked for five years at Florida State University in the Actinide Source Term Test Program coordinated by Sandia National Laboratories and lectured the Radiochemistry course for graduate students. Next he moved to Argonne National Laboratory where he spent two and one half years working as a visiting scientist in the Transuranium Chemistry Group.
Marian Borkowski obtained a Ph.D. in Radiochemistry from the Institute of Nuclear Chemistry and Technology, Warsaw, Poland. He is coauthor of almost 50 papers and many contributions to national and international conferences.

Donald T. Reed has an extensive background in the nuclear field and has published over 60 papers on microbiological-actinide interactions, actinide environmental chemistry,

synchrotron-based studies of actinide systems, and radiolytic effects. Of particular importance to the LANL activities in Carlsbad, he was a principle investigator in WIPP related research in radiation effect studies and the actinide source term program. Prior to joining LANL, Dr. Reed spent 15 years in the Chemical Technology Division at Argonne National Laboratory and also three years at Rockwell Hanford Operations where he managed and implemented several projects related to nuclear waste management and environmental actinide chemistry. He received his Ph.D. in physical chemistry from Ohio State University and is an active member of the American Chemical Society, the American Geophysical Union, and American Nuclear Society.

Two post-docs, Dr. Jean-Francois Lucchini and Dr. Andrzej Rafalski, and the team leader, Dr. James L. Conca, complete the AC team.

Jean-Francois Lucchini joined EES-12 at Carlsbad in September 2002. He obtained a Ph.D. in Chemistry, specialization Radiochemistry, at the University of Paris XI, France in 2001. During his Ph.D. thesis, Jean-Francois studied Water Alpha-Radiolysis Effects on $UO_2$ Alteration at two Nuclear Research Centres of the Commissariat a l'Energie Atomique (CEA – France). Prior to coming to LANL, Jean-Francois worked five years in his favorite field, Nuclear Waste, at the most well know nuclear facilities in France (CEA Saclay, CEA Marcoule, COGEMA La Hague).

Andrzej Rafalski came to EES-12 in October 2002. He obtained a Ph.D. in Chemistry, specializing in Radiation Chemistry of Polymers, at the Institute of Nuclear Chemistry and Technology, Warsaw, Poland in1999. Andrzej developed and used the radioisotope methods in industrial investigations, and he studied the radiolysis of polymers, mainly polypropylene. For three years prior to coming to LANL, Andrzej studied particularly the decomposition of virgin polypropylene at elevated temperatures and the radiolysis of polymers by means of Diffuse Reflection Spectrophotometry.

James L. Conca is a Project Leader and Staff Scientist at LANL. For the last 19 years, Conca has been developing and testing laboratory and field technologies for disposal of radioactive waste and remediation of metal and radionuclide contamination in soils and groundwater. He transferred from LANL at Los Alamos where he was Section Leader of Radionuclide Geochemistry and Principle Investigator on the Yucca Mountain Project, and relocated to LANL in Carlsbad (LANL/CB) at the end of 2000 to help develop the Repository Science Program and the new Actinide Chemistry Facility. He works closely with DOE CBFO, NMSU CEMRC, and SNL CB. Jim Conca still holds a faculty position at Washington State University, and has been a consultant for government agencies such as Lawrence Livermore National Laboratory, Pacific Northwest National Laboratory, the United States Geological Survey, and many private companies. Jim obtained a Ph.D. in Geochemistry in 1985 from the California Institute of Technology.

## An overview of the LANL/CEMRC Actinide Chemistry Program

WIPP actinide scientific issues, related to licensing and re-certification, are the technical driver for research in the Actinide Chemistry Program area. These issues are:

- *Oxidation state distribution of multivalent actinides in WIPP,*
- *Oxidation-state specific solubility under WIPP conditions,*
- *Solubility of actinides as a function of brine composition, pH and carbonate concentration,*

- *Effect of repository constituents (e.g., iron, magnesium oxide, complexants) on actinide redox and sorption chemistry,*
- *Effect of radiolytic products on redox conditions and actinide speciation.*

Presently, the research effort is focused on the stability/solubility of U(VI), as a function of key subsurface parameters (e.g. brine composition, carbonate concentration, pH and oxygen content). Key mechanisms that lead to the reduction of U(VI) in WIPP will also be investigated. This will include repository components and subsurface processes, known to reduce actinides. The possible effect of key radiolytic molecular products (e.g., hydrogen peroxide and hypochlorite ion) on uranium speciation (see Figure 4) will also be investigated, since radiolysis remains the primary pathway for actinide oxidation.

Figure 4: Marian Borkowski is using the CARY 500 Spectrometer.

Spectrometry is widely used to study actinides speciation. This technique will be used to monitor the oxidation state of uranium in brine.

In addition to the scientific results, a key goal of the uranium studies is to develop the experimental protocols to extend the uranium studies to investigate plutonium and americium chemistry in WIPP brines at the CEMRC facility.

A secondary, but important goal of the AC Program is to promote interest in radiochemistry, nuclear training and science education through our relationship with NMSU and indirect ties with the LANL Seaborg Institute. The 2003 Radiochemistry Conference, held in Carlsbad on July 14-16, emphasized on the decrease in teaching and training opportunities in radiochemistry within the United States, which poses a serious strategic threat to future operations.

No doubt that the new EES Actinide Chemistry team in Carlsbad will take up this challenge, along with its primary mission to support WIPP repository performance!

**News, Views & EEScience:**

**A Monthly Newsletter from**
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